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What Contributes to Action Plan Enactment?

Examining Characteristics of Physical Activity Plans

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Abstract

Objectives: Individuals with chronic conditions can benefit from formulating action plans to engage in regular physical activity. However, the content and the successful translation of plans into action, so called plan enactment, is rarely adequately evaluated. The aim of this study was to describe the content of user-specified plans and to examine whether participants were more likely to enact their plans if these plans that were highly specific, viable and instrumental. *Design and Methods:* The study presents secondary analyses from a larger behavioral intervention in cardiac and orthopedic rehabilitation. The content of 619 action plans from 229 participants was evaluated by two independent raters (i.e., qualitative analyses and ratings of specificity) and by participants themselves (i.e., instrumentality and viability). Plan enactment was also measured via self-reports. Multilevel analyses examined the relationship between these plan characteristics and subsequent plan enactment, and between plan enactment and aggregated physical activity. *Results:* Participants preferred to plan leisure time physical activities anchored around time-based cues. Specificity of occasion cues (i.e., when to act) and highly instrumental plans were positively associated with plan enactment. Interestingly, individuals who planned less specific behavioral responses (i.e., what to do) were more likely to enact their plans. Plan enactment was positively associated with aggregated behavior. *Conclusions:* Interventions should not only emphasize the importance of planning, but also the benefits of formulating specific contextual cues. Planning of the behavioral response seems to require less precision. Allowing for some flexibility in executing the anticipated target behavior seems to aid successful plan enactment.

Keywords: plan enactment; specificity; implementation intentions; instrumentality; viability; action plans; physical activity; rehabilitation

Health behavior is central to the prevention and management of chronic diseases (Fisher et al., 2011). Behavior change interventions for physical activity in clinical settings are complex and usually include a variety of behavior change techniques. Action planning is a self-regulation technique that can help rehabilitation patients to embed physical activity in their daily routines after discharge (Janssen, De Gucht, van Exel, & Maes, 2014; Ziegelmann, Lippke, & Schwarzer, 2006). Making an action plan to achieve a desired behavior change includes multiple discrete components, such as specifying a behavioral response (i.e., what to do), an occasion or time (i.e., when), a place (i.e., where), and an activity partner (i.e., with whom). Implementation intentions, also called "if-then"-plans (Gollwitzer, 1999, 2014), are a specific form of action plans which explicate a set of anticipated contextual cues, and explicitly link them with a behavioral response.

Efficacy of Planning Interventions: From Unconditional to Conditional Outcomes

Systematic reviews have generally supported the merits of using these planning techniques for promoting health behavior change (Gollwitzer & Sheeran, 2006), including energy-related behaviors such as physical activity (Bélanger-Gravel, Godin, & Amireault, 2013) and healthy eating (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011). However, the positive impact of action planning on physical activity is not always replicated (e.g., De Vet, Oenema, Sheeran, & Brug, 2009; Knoll et al., in press). This may in part be a methodological problem; the successful translation of plans into action is rarely adequately tested (BLINDED FOR REVIEW; Sniehotta, 2009). Planning success is usually measured in terms of positive outcomes on distal health outcomes or aggregations of behavior, such as weight (Benyamini et al., 2013), self-reported (Fuchs, Goehner, & Seelig, 2011) or objectively-measured physical activity (Janssen et al., 2014; Knoll et al., in press), or habit strength (e.g., Fleig et al., 2016;

Orbell & Verplanken, 2010). However, these outcomes fail to capture whether participants actually enact the planned action when encountering the contextual cues specified within the plan. Information on such conditional, behavioral outcomes (i.e., behavior enactment upon the condition that plan-specific, contextual cues are present) can provide a more fine-grained picture of whether and why action planning results in overall behavior change (Sniehotta, 2009). In line with Sniehotta (2009), de Vries, Eggers, and Bolman (2013) have coined the term *plan enactment* to refer to the extent that individuals execute their plan as intended. De Vries et al. (2013) introduced a measure of plan enactment and provided evidence that individuals who act according to their plan were indeed more likely to change their overall behavior over the longer term (i.e., quit smoking). Similarly, Verbiest et al. (2014) found that health professionals who executed their plans as intended, were more likely to provide smoking cessation care to their patients. Whereas previous research supports the positive link between plan enactment and overall behavior change, little is known about which plan characteristics contribute to enactment.

What Contributes to Plan Enactment? Characteristics of Action Plan Content

In terms of action plan content, a common distinction is made between externally-generated action plans (i.e., plans developed by someone other than the user) and user-specified plans (Hagger & Luszczynska, 2014). Instead of letting participants choose from a pre-determined list of plan components, field-based researchers usually allow participants to author the content of their plans. The *specificity* of such self-generated plans can, therefore, vary highly and affect subsequent plan enactment and overall behavior change (Gardner, Sheals, Wardle, & McGowan, 2014). Highly specific plans, for example, may increase the likelihood that individuals perform an intended behavior (van Osch, Lechner, Reubsaet, & Vries, 2010). This notion is based on the idea that individuals who describe the anticipated behavior and context

with sufficient precision (what, when, where, with whom), will recognize the critical situation more easily (Gollwitzer, 1999) and will, therefore, be more likely to respond as they had previously planned (see Figure 1). As illustrated in Figure 1, plan enactment, in turn, may result in more overall behavior change (i.e., unconditional behavior; de Vries et al., 2013; Verbiest et al., 2014). The positive link between the specificity of self-formulated plans and unconditional behavioral (Verbiest et al., 2014; Ziegelmann et al., 2006) and behavior-related outcomes (Dombrowski, Endevelt, Steinberg, & Benyamini, in press) has been supported in several studies, in particular among those individuals who were motivated to change. *Instrumentality* (de Vet, Gebhardt, et al., 2011; Reinwand et al., 2016; van Osch et al., 2010) has also been proposed as an essential characteristic of plans. Instrumentality refers to the degree that a plan helps to achieve a desired behavior or health outcome. Plans that facilitate the achievement of a desired outcome should, therefore, contribute to plan enactment and longer-term behavior change (see Figure 1; van Osch et al., 2010). Previous research suggests that highly instrumental plans, as measured by participant and post-hoc experimenter ratings, were linked to condom preparatory behaviors (de Vet, Gebhardt, et al., 2011), but not to smoking cessation (de Vries et al., 2013). To date, there seems to be no study that has examined a combined set of action plan characteristics (Figure 1) in the context of a field-based physical activity intervention. Furthermore, plan characteristics have been investigated in relation to behavioral aggregates and health-related outcomes (Dombrowski et al., in press) but have yet to be addressed in relation to context-dependent, behavioral outcomes, such as plan enactment. Moreover, plan characteristics have usually been studied in terms of specificity, but not regarding instrumentality and viability. *Viability* refers to the idea that successful goal striving depends on whether people have actual control over their behavior in terms of physical abilities, resources (e.g., equipment), and

opportunities (e.g., physical environment; Paschal Sheeran, Milne, Webb, & Gollwitzer, 2005). Similarly, individuals may only succeed in enacting their action plans if they do not lack the external resources required to do so. This study goes beyond previous research by examining the effects of three different plan characteristics on subsequent plan enactment.

Aims

The first aim of this mixed-methods study was to describe the content of physical activity-related plans. To do so, this study examined user-specified plans that participants generated as part of an online intervention in rehabilitation. As shown in Figure 1, this study focussed on 4 different plan components: the planned behavioral response (i.e., what), the anticipated location (i.e., where), occasion (i.e., when), and the social cue (i.e., with whom). Secondly, this study aimed to describe the content of plans covering three different aspects. Independent raters evaluated the precision with which participants specified what activity they wanted to do, and when and where they intended to be physically active (i.e., *specificity*). Moreover, participants themselves rated how instrumental their plans were in achieving personal, behavior-related health goals (i.e., *instrumentality*) and the extent to which they could feasibly enact their planned action (i.e., *viability*). The third aim was to examine the extent to which these content characteristics contributed to plan enactment. Figure 1 illustrates the conceptual model of this study. Based on theory (Gollwitzer, 1999) and previous research, it was hypothesized that individuals would be more likely to enact action plans that were (*1*) highly specific (Dombrowski et al., in press; Verbiest et al., 2014), (*2*) highly instrumental (de Vet, Gebhardt, et al., 2011) and (*3*) viable. Finally, it was explored whether plan enactment would vary according to (*4*) the presence or absence of an activity partner, and (*5*) the plan rank. Plan rank refers to the order in which the action plan was written by the participant (i.e., first action plan generated is rank 1,

second is rank 2, etc.). It may be speculated that those plans that participants form first are more successful as individuals tend to choose better situational cues. The present study presents post-hoc analyses of an existing data set based on a larger behavior intervention. Action planning was only one of the behavior change techniques used in the intervention, and the initial study did not evaluate the content of this single intervention component. Therefore, the present study further examines the characteristics of plans and their association with plan enactment.

Method

Study Context, Design and Participants

The *(BLINDED FOR REVIEW)* study evaluated the impact of a psychological, computer-based expert system on orthopedic and cardiac patients' health and health behavior. This study presents secondary analyses of data from a larger intervention trial (BLINDED FOR REVIEW) with 1,166 individuals who participated in an orthopaedic or cardiac rehabilitation program. Participants were German-speaking adults, aged ≥18 years, who had the recommendation to engage in regular leisure-time physical activity after discharge. Finer details of the recruitment approach and the participant flow are provided elsewhere (BLINDED FOR REVIEW). Briefly, 630 participants in the intervention group completed in-person, interviewer-assisted measurement sessions at the beginning of rehabilitation. Follow-up data at the end of rehabilitation (Time 1[T1]) was available from 449 participants. All participants completed the online-based expert system including the action planning component. Intervention group participants were excluded from the present study if they did not form any plans or formed incomplete (i.e., specified a behavioral response but no behavior-triggering contextual cue) or

non-valid plans[1] (i.e., non-valid entry according to required action plan component'; e.g., 'Monday' when location was asked for). For the present analyses, 619 complete action plans (i.e., specified at least one valid behavioral response and at least one valid behavior-triggering cue) of 229 participants were considered for subsequent qualitative and quantitative ratings. Of these, 173 participants participated in the follow-up computer-assisted telephone interviews (CATIs) six weeks after rehabilitation (Time [T2]). Of those, 163 completed the interviews and were included in the longitudinal sample. BLINDED FOR REVIEW granted ethics approval for this study.

Intervention

Individuals in the intervention group received usual care for their clinical indication, and they received access to a computer-based expert system aimed at promoting physical-activity-related, self-regulatory strategies; personal resources, habit formation as well as behavior and health status (for additional detail, see BLINDED FOR REVIEW). The present analyses focused on the action planning component of the intervention. At the end of rehabilitation, after filling in the online-based self-report questionnaires (T1), participants could form up to three action plans. For each of the three plans, participants formulated the goal behavior (i.e., type of physical activity) and specified up to three cues relevant to action initiation. On the computer system, participants wrote down when (day and time of day), where (location), and with whom they wanted to be physically active in the four weeks following discharge (for more detail on intervention and on behavior change techniques, see BLINDED FOR REVIEW). A trained staff

[1] These data were excluded because, where it was not clear what activity the person planned to do, or when and where the person wanted to do it (i.e., non-valid entry), plan enactment could not be measured.

member was present to assist participants in case of technical or content-related questions and provided participants with a take-away summary of their plans.

Measures

Action plan enactment (dependent variable).

To assess *action plan enactment*, participants rated the extent to which they had enacted their specific action in the specific contexts set out in their plan. Six weeks after rehabilitation (T2), participants completed CATIs. Similar to Verbiest et al. (2014), interviewers reminded participants of the exact action plans they had generated six weeks ago, at the end of rehabilitation (T1). This was possible as participants' plans from T1 were electronically stored in the online expert system. For each action plan, interviewers read out the planned behavioral response, the (set of) occasion cue(s) as well as the (set of) location cue(s). Participants in the intervention group rated the extent of plan enactment separately for each action plan on a scale from 0% (not enacted as planned at all) to 100% (completely enacted as planned).

Characteristics of action plan content (independent variables).

Aligned with previous research and theory, the following independent variables were measured.

Specificity of planned contextual cues and planned behavioral response. To measure *plan specificity*, two independent raters (health psychologist, bachelor student in public health; BLINDED FOR REVIEW) scored each action plan based on a coding scheme, iteratively refined and developed to evaluate plan specificity (see Appendix B for coding manual). Similar to previous studies, two independent raters (BLINDED FOR REVIEW) evaluated the components of each action plan separately (de Vet, Gebhardt, et al., 2011; de Vet, Oenema, & Brug, 2011; Dombrowski et al., in press; Reinwand et al., 2016; Verbiest et al., 2014). First, the specificity of

the planned behavioral response was rated, followed by the contextual cues, the occasion (i.e., when) and the location (i.e., where). Ratings for each component were conducted on a multiple-point scale, ranging from 1 (unspecific/vague) to 3 (highly specific, see Appendix B for details on the coding manual; Verbiest et al., 2014). To ensure reliability and standardization of the coding procedures, two independent raters (BLINDED FOR REVIEW) initially rated 15 action plans and then discussed any disagreements with two other co-authors (BLINDED FOR REVIEW). This helped to fine-tune and iteratively refine the coding manual. Next, two raters independently coded the remaining action plans. Cohen's kappa inter-rater agreement ranged from .74 (i.e., location cues) to .92 (i.e., occasion cues). Raters solved disagreements through discussions and by consulting two additional experts (BLINDED FOR REVIEW).

Planned co-activity (i.e., with whom). Participants reported whether they preferred to be physically active by themselves or with others (e.g., partner or dog). For each action plan, participants' entries were categorized into 0 'alone' or 1 'with someone else'.

Viability of planned behavioral response. To measure the extent to which participants could feasibly enact their planned *action*, participants rated how realistic each of their physical activities would be in terms ofa resources (i.e., sufficient time, equipment) and rated whether the action was congruent with contextual demands (i.e.,no potential conflict with existing routines; Fuchs et al., 2011). At the end of rehabilitation (T1), participants in the intervention group rated each action plan separately on a scale from 1 (not realistic at all) to 10 (very realistic).

Instrumentality of overall plan. To assess *plan instrumentality*, participants rated the degree to which they believed each of their action plans would help them to achieve their personal health-related goals (Fuchs et al., 2011). At the end of rehabilitation (T1), participants

in the intervention group rated each action plan separately on a scale from 1 (not helpful at all) to 10 (very helpful).

Behavior, social-cognitive variables and covariates.

Physical activity habits prior to rehabilitation were measured at the beginning of rehabilitation with two items adapted from the Self-Report Habit Index (Verplanken & Orbell, 2003). Participants were asked to think about the past four weeks and their previous level of physical exercise. The items were worded: "Being as physically active as I have been during the last month is something" (a) "…I do without thinking about it," (b) "…that has become a confirmed habit for me." Answers could be given on a 6-point Likert scale with the anchors "not at all" (1) to "very much" (6).

Physical activity at T2 was measured with a modified version of the Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985; Plotnikoff et al., 2007). Participants indicated how many sessions per week and how long per session they performed vigorous and moderate exercise.

Intention to engage in regular physical activity after discharge was assessed at the end of participants' stay at the rehabilitation centre (T1) using three items that asked participants to rate how much they intended to engage in mild, moderate, and vigorous physical activity (Lippke, Fleig, Pomp, & Schwarzer, 2010). The items were introduced by the stem "I intend to perform the following activities at least three [two] days per week for 40 [20] minutes. . ." (a) ". . . strenuous (heart beats rapidly, sweating) physical activities;" (b) ". . . moderate (not exhausting, light perspiration) physical activities;" and (c) ". . . light (minimal effort, no perspiration) physical activity." Responses were given on a 6-point scale from "not at all true" (1) to "absolutely true" (6). *Self-efficacy* to engage in regular physical activity after discharge was

assessed at T1 with four items (Lippke et al., 2010). The item stem "I am certain that I can be active on a regular basis..." was followed by (a) "…even if I have to motivate myself", (b) "…even if it is difficult", (c) "…even if it takes some time until it become a routine", and (d) "…even if I need several attempts until I am successful." Answers were given on a 6-point scale from "not at all true" (1) to "absolutely true" (6). *Action planning* was measured at T1 with 2 items: (a) "For the next month, I have already planned where, when, and how I will be physically active" (Schwarzer et al., 2007), and (b) "Usually, I make specific plans for my physical activities." (BLINDED FOR REVIEW). *Perceived satisfaction* was measured at T2 using 1 item "As of today, how satisfied are you with what you have experienced as a result of engaging in physical activity?". The item was answered using a 6-point scale from very unsatisfied (1) to completely satisfied (6). The measure has been previously used in the smoking (Baldwin, Rothman, Hertel, Keenan, & Jeffery, 2009) and weight domains and was adapted to physical activity as target behaviour (BLINDED FOR REVIEW). In addition to *sex*, *age* and *patient group* (orthopaedic vs. cardiac) were included in the analysis. Participants' *engagement* in the intervention was measured as the ratio of the number of possible entries (n=60) and the number of actual interactions of the participant with the expert system. As an indicator of health status, body mass index (BMI = weight (kg)/height (m^2) was also assessed based on self-reported height and weight.

Data Analysis

Qualitative analysis.

To analyse action plan content, the framework method (Gale, Heath, Cameron, Rashid, & Redwood, 2013) was applied. Two authors (BLINDED FOR REVIEW) individually familiarized themselves with participants' entries, and developed a conceptual model with codes for each of

the action plan components. After coding the first few action plans, raters compared applied labels, and agreed on a set of codes to apply to all subsequent action plans. To derive more specific themes, each of the predefined action plan categories (e.g., where) was further subdivided (e.g., outdoor location, indoor location). Based on this working analytical framework both raters independently coded action plans generating a matrix in an Excel spreadsheet. The raters discussed the spreadsheets, compared and agreed upon coding allocations.

Quantitative analysis.

Variables were summarized using counts and proportions for categorical variables (sex, patient group) and means and standard deviations for continuous variables. Dropout analyses compared participants who remained in the study with those who did not complete T2 using t-tests for continuous and χ^2-tests for categorical measures. To test associations with plan enactment, a two-level model with action plans (level 1) crossed in persons (level 2) was fitted using a maximum likelihood estimation in Mplus 7. Plan rank, instrumentality, viability, planned co-activity, and specificity ratings were modelled as level 1 fixed effect predictors. As level 2 predictors, pre-rehabilitation physical activity habits, physical-activity-related social-cognitions (i.e., intention, self-efficacy, action planning, and satisfaction), socio-demographic variables (i.e., sex, age, patient group), and participants' overall intervention engagement were included in the two-level model. Level 2 models were initially tested for random effects. Random-effects parameters were only retained if random-effects variances were significant. All predictor variables were grand-mean centred. The intraclass correlation was computed to estimate the percentage of the total variance in the dependent variable (i.e., plan enactment) due to differences between the three plans. Missing data (< 5%) were treated using the full maximum likelihood (FIML) algorithm.

Results

Descriptive Analysis: Intervention Engagement, Completion of Plans, and Drop-out

On average, participants interacted 40.11 times (*SD*=8.17, range 17 – 59) with the online expert system at T1, either by making entries into the online forms or by clicking on pop-up windows. In other words, participants engaged in and completed 66.9% of all intervention tasks. Regarding the action plan component of the intervention, 75.1% of respondents (*n*=172) formed three complete action plans. Participants' completion rate declined steadily from action plan 1 to action plan 3 (see Appendix A). On average, each participant filled in 2.69 (*SD*=0.55) complete action plans at T1.

The mean age of the longitudinal sample was 49.68 years (*SD* = 9.42; range 21-77 years). More than half of all participants were women (58.8%). Most participants had an orthopedic injury, musculoskeletal problems, or a previous orthopedic surgery (83.6%) and spent their rehabilitation in an inpatient rehabilitation centre (71.8%). Average BMI was 28.23 (*SD*=5.56, range 18.43 – 47.62). Regarding covariates, there were no significant differences between participants who dropped out and those who remained in the study. Participants who completed the follow-up interviews, however, rated the instrumentality (*M*=8.98, *SD*=8.91) and viability (*M*=8.74, *SD*=8.92) of their action plans significantly higher than those who dropped out of the study ($M_{Instrumentality}$=7.88, *SD*=8.13; $M_{Viability}$=8.74, *SD*=8.92; $p < 0.05$).

Qualitative Analysis: Content of Action Plans

To describe where, when and with whom participants planned to be physically active, 619 action plans of 229 participants were coded. Another goal of the qualitative analyses was to describe what type of physical activities participants intended to engage in after rehabilitation. The extracted themes are summarized in Appendix A (Table 2) and briefly expanded on below.

Occasion and location cues: When and where do rehabilitation patients plan to be physically active?

Participants identified *time-related cues* (e.g., Mondays at 5 p.m.), *frequency-related cues* (e.g., twice per week) and *routine-related cues* (e.g., when I come home from work). As per intervention instruction, participants most frequently referred to a time-related cue (68.1%; e.g., specific day and time of day), followed by frequency-related cues (13.6%; e.g., frequency and time of day) and routine-based cues (6.7%; e.g., routine and day; see Appendix A, Table 2 for further details). Most participants referred to an indoor location for their planned post-rehabilitation physical activities (49.7%; e.g., swimming pool, rehabilitation center, at home; see Appendix A, Table 2 for further details).

Planned co-activity: Do rehabilitation patients plan to be active with someone else?

Nearly half of all participants planned to be physically active *with someone else* (48.3%). Of those, 78% reported that they wanted to exercise with a *casual partner* (e.g., friend, colleague, relative) and 16.1% planned to be active together with someone *professional* (e.g., trainer, physiotherapist; see Appendix A, Table 2 for further details).

Planned behavioral response: What do rehabilitation patients plan to do?

Three different subthemes emerged for the planned physical activities: the source of physical activity, the type of physical activity, and the intensity level. The planned activities fell into three common sources of physical activity including *lifestyle-integrated activities* (e.g., active commuting), *leisure time fun activities* (e.g., swimming, dancing, walking), and *health-related fitness and physiotherapy* (e.g., physiotherapy, back exercises). The most common category across all action plans (n=619) was leisure time physical activity (63.3%), followed by lifestyle-integrated activity (18.9%) and health-related fitness activity (16.8%; see Appendix A, Table 2

for further details). Participants frequently referred to various physical activities, i.e., *muscle-strengthening* (e.g., back exercises), *and aerobic physical activities* (e.g., walking), *flexibility and balance promoting activities* (e.g., stretching exercises) or a combination of thereof. Participants most frequently planned to engage in aerobic activities (49.1%), an activity that served at least two health-goals (24.7%; e.g., aerobic and muscle-strengthening activity) followed by muscle-strengthening activities (20.5%) and flexibility and balance activities (2.1 %). Whereas some participants planned to engage in *light physical activities* (7.4%; e.g., going for a walk), most participants planned to engage in moderate (78.4%; e.g., Nordic walking) and vigorous physical activities (31.1%; e.g., jogging; see Appendix A, Table 2 for further details).

Quantitative Analyses

Action plan characteristics: Specificity, instrumentality and viability.

As presented in Table 1, the specificity of participants' entries was generally high (i.e., above the scale mean of 1.5), but continuously dropped from action plan 1 to action plan 3. Participants achieved highest specificity ratings for the behavioral response, followed by the location and the occasion cue (see Table 1). Co-activity ratings did not significantly differ across action plans (see Table 1). With regards to the other two plan characteristics, participants consistently rated their plans as being highly instrumental and viable (see Table 1).

Plan enactment, action plan characteristics and aggregated physical activity.

As presented in Table 1, plan enactment was moderately high and the average rate of plan enactment ranged between 53.7% and 56.3%. Plan enactment (level-1 variable) was substantially and positively associated with self-reported, aggregated physical activity (level-2 variable) at follow-up (r=.59; bivariate association, see Figure 2). One of the major goals of this study was to determine whether and to what extent different characteristics of plan content contributed to plan

enactment. The results of the final model are illustrated in Figure 2. As hypothesized, specificity of occasion cues and instrumentality were positively associated with subsequent plan enactment. Contrary to expectations, specificity of the planned behavioral responses was negatively associated with plan enactment. Specificity of location cues and viability of action plans were not related to plan enactment. Similarly, the anticipated presence of an activity partner, plan rank and pre-rehabilitation activity habits did not yield any significant associations with plan enactment. Of all social-cognitive control variables, self-efficacy and satisfaction, but not intentions and action planning, were significantly related to plan enactment (see Figure 2). Finally, intervention engagement, age, sex, and patient group were not associated with plan enactment.

Discussion

This study aimed to describe the content and characteristics of action plans that rehabilitation patients formed for post-discharge physical activity within a larger behavioral support program. It also investigated which characteristics of action plans contributed to their subsequent enactment.

Plan Content: Leisure-time Activities Anchored Around Time-based Occasion Cues

Qualitative analyses of action plans provided insights into the types of physical activities and contextual cues individuals formulated. Similar to findings from de Vet et al. (2010), individuals most frequently planned to engage in leisure time physical activities, whereas lifestyle integrated activities such as active transportation or smaller bouts of lifestyle integrated physical activity (e.g., taking the stairs, small balance and strength exercises) were less common. Future trials may encourage individuals to increase physical activity not only through engaging in leisure-time physical activity but also through performance of lower threshold, lifestyle integrated

activities of lighter intensity (Manns, Dunstan, Owen, & Healy, 2012). Analyses further emphasized the acceptability and efficacy of anchoring physical activities around time-based (e.g., specific day and time of day) or frequency-based context cues (e.g., twice a week). This preference towards time-based cues is, however, no surprise given that examples in the planning sheet instruction explicitly directed participants to think about a specific time or day of the week. Individuals may be just as or even more successful to enact their plans and change their behavior if they anchor their planned activities around existing routines (BLINDED FOR REVIEW; Fleig et al., 2016; Judah, Gardner, & Aunger, 2013; Pimm et al., 2015) or mood cues (Pimm et al., 2015). Unlike time-based cues (e.g., Monday at 8pm), activities (e.g., after coming from work), events (e.g., behavioral response linked to an object in the environment) and mood cues do not require conscious monitoring to be detected (Judah et al., 2013) and may be retrieved more easily from memory (McDaniel & Einstein, 2000). Future research may randomize individuals to different 'cue'-planning conditions to examine which type of cue (e.g., activity, event, time, social or mood cue) is most beneficial for plan enactment and overall behavior change.

Specificity and Instrumentality are the Plan Characteristics that Matter for Plan Enactment

Overall, individuals rated their action plans as being highly viable and instrumental in achieving their behavior-related goals. Similarly, specificity of plans was generally high. Regarding the discrete plan components, specificity was highest for the behavioral response, followed by the location and the occasion cues.

As expected, specificity of occasion cues and highly instrumental plans were associated with higher plan enactment six weeks after rehabilitation. In contrast to hypotheses, the reverse pattern was found for the specificity of planned behavioral responses. Individuals who

formulated less specific physical activities were more likely to enact their plans. Whether participants provided details on the planned location or whether they planned to be physically active with others (i.e., co-activity) was not related to plan enactment. The same was true for plan rank and plan viability. This implies that individuals are most likely to enact their plans when they generate plans that include very specific occasion cues, and, at the same time, are instrumental in achieving behavior-related health goals. In terms of the planned behavior, however, it seems to be more beneficial if individuals retain some flexibility as to which behavior is to be performed.

Relation to Theory and Previous Research

The quantitative findings extend the current literature in three ways. This is probably the first study to examine the link between three different plan characteristics and subsequent plan enactment. Whereas previous field-based, planning interventions have focused on distal health outcomes (e.g., Dombrowski et al., in press) or aggregations of behavior (e.g., MVPA, Knoll et al., in press), the present study included plan enactment as a context-dependent, more proximal behavioral intervention outcome.

Second, unlike previous research (de Vet, Oenema, et al., 2011; van Osch et al., 2010), the present study used a continuous rather than a dichotomous rating scheme to evaluate the *specificity* of the separate action plan components. Thereby, differential associations between plan enactment and the specificity of the behavioral response as well as the contextual cues, could be disentangled. Among the present sample, action plans seemed to work best when the intended behaviours were not so tightly specified while the cues to action were specified as precisely as possible while

Supporting theory (Gollwitzer, 1999), the present findings showed that more specific occasion cues resulted in higher plan enactment. Having a precise mental representation of the anticipated behavioral context (i.e., occasion cue) seems to be a prerequisite for the detection of good opportunities to act (Gollwitzer, 1999). The more precisely individuals spell out the occasion in advance, the more accessible the mental representation of the situation may become – individuals should, as a result, find it easier to identify the critical situation when they encounter it (Sheeran & Webb, 2016). This raises, however, the question of whether the observed gains of highly specific occasion cues may come at the cost of increased 'rigidity' of detecting appropriate cues: People may not take advantage of alternative opportunities anymore (Gollwitzer, Parks-Stamm, Jaudas, & Sheeran, 2008). Previous lab-based research suggests that despite previously formed if-then plans, individuals *were* able to respond flexibly and take advantage of alternative opportunities (Jaudas & Gollwitzer, 2004 , cited in Gollwitzer et al., 2008). Future field studies should aim to capture such, potentially detrimental, 'side effects' of plans. Regarding the planned action, findings showed that the fewer details individuals provided about their activity in advance, the more successful they were to enact their plans. This supports the notion that over-specification of the target behavior might be detrimental for future behavior change as it does not permit flexibility (van Osch et al., 2010). This would suggest that individuals' plans, among the present sample, operated to cue physical activity goals, which in turn cued physical activity (i.e. flexible responding).

Moreover, participants' general intention to be physically active did not contribute to plan enactment. This is in contrast to previous research which showed that more specific plans were particularly beneficial if individuals were highly motivated (Dombrowski et al., in press;

Verbiest et al., 2014). At the time of discharge from rehabilitation, most participants in the present sample reported being highly motivated to remain physically active. As it would be expected from individuals who are already motivated to continuously engage in behavior (Rothman, Baldwin, Hertel, & Fuglestad, 2004), self-efficacy and satisfaction with physical activity outcomes, rather than intention, facilitated plan enactment.

A third innovation of the present paper lies in the investigation of instrumentality and viability as two additional plan characteristics (besides specificity) to aid enactment. In contrast to previous research (van Osch et al., 2010), highly instrumental plans were associated with higher plan enactment. This may be explained by the fact that the present study assessed instrumentality in a different way. Whereas van Osch et al. (2010) used post-hoc expert ratings, the present study asked participants to rate the instrumentality of their plans by themselves. Interestingly, our measure of viability, which we operationalized as a combination of whether participants had sufficient external resources (e.g., equipment) and whether the action was congruent with contextual demands, was not related to plan enactment. Future studies may use more fine-grained measures to disentangle the effects of external resources, competing actions, and internal mental resources (e.g., plan execution self-efficacy; Scholz, Sniehotta, Schüz, & Oeberst, 2007) on plan enactment. To sum up quantitative findings, the present study suggests that specificity of occasion cues, flexibility in behavioral responses, and perceived plan instrumentality are the key aspects to facilitate plan enactment.

Strengths and Limitations of the Study

Limitations must be acknowledged. One major limitation is the correlational nature of the analyses; specificity ratings were performed post-hoc and participants were not randomized to different intervention instructions (e.g., high vs. low specificity). However, the time lag of six

weeks between the completion of the action planning component and the measurement of plan enactment support the hypothesized associations.

The primary outcome of the present study was self-reported plan enactment. The self-report data may be open to consistency bias. An alternative method for assessing plan enactment would involve collecting objective observational data on whether the specific behaviour is enacted in the planned context. This may be possible in studies where participants are likely to specify a limited range of behaviors for performance in a limited range of contexts (e.g. brushing teeth, typically done in the bathroom), as this would allow for objective behavior monitoring devices to be used. However, this was not possible in our study, given that participants could choose from a broad range of physical activity behaviors, each of which could realistically be enacted in a variety of contexts.

In addition, plan enactment was measured only once after the intervention. One avenue for future research is to apply more intense, longitudinal research designs to understand whether and how individuals adapt their original plans (i.e., plan adjustment) and how this affects continuous plan enactment and overall health behavior. In line with previous research in the smoking domain (de Vries et al., 2013; Verbiest et al., 2014), present findings provide preliminary evidence that differences in the extent to which people were able to enact their plans was substantially associated with aggregated, self-reported physical activity.

Future studies should also include more detailed measures of previous behavior (e.g., information on behavioral context, cues to action) to better disentangle action plans that merely describe previous behavior (i.e. ‘automatic’ action plans) in comparison to plans that refer to new behaviors (i.e. deliberate action plans). In the present study, participants’ general physical activity habits prior to rehabilitation were included as control variable, but did not show any

meaningful associations with plan enactment at follow-up. This finding partially rules out that those participants with strong pre-rehabilitation habits were also more likely to have enacted their plans.

Another limitation refers to the assessment of plan instrumentality and instrumentality. Participants rated their own plans in terms of enactment, instrumentality and viability and might, therefore, have been predisposed to rating their plans positively. However, one might argue that participants themselves, rather than external raters, know best if a plan is viable and instrumental in achieving personal health goals. Future studies may combine self-reports and expert ratings. Besides plan-related characteristics, memory processes such as the ability to remember to carry out one's goal intentions in the future (i.e., prospective memory; McDaniel & Einstein, 2000) are likely to affect physical activity (Wolff, Warner, Ziegelmann, Wurm, & Kliegel, 2016) and plan enactment and should be considered in future studies. ,Finally, our findings only refer to physical-activity related action plans. It is up to future research to investigate whether results can be generalized to other type of plans (e.g., plans that include a personally relevant obstacle in the if-part; (Adriaanse et al., 2010)) and to other behavioral contexts (e.g., environmental behavior; Bell, Toth, Little, & Smith, 2016).

Practical Implications

The present results provide some important implications for optimizing the delivery and implementation of planning interventions. That participants were highly engaged in the intervention and the planning module (i.e., high completion rates), particularly speaks to the acceptability and feasibility of the planning intervention format (i.e., user-specified planning, online with interviewer support). In terms of intervention instructions, the present findings suggest that interventions should not only focus on the importance of planning per se, but also on

the benefits of setting highly specific occasion cues (e.g., by creating intervention material in such a way that participants have to fill in at least two input fields for their occasion, a 'weekday'-field and a 'time/routine'-field). At the same time, instructions should emphasize the merits of questioning the link between one's action plan and one's behavior-related goals (i.e., whether the plan facilitates movement towards goal achievement; instrumentality) as well as the benefits of accommodating some behavioral options for the execution of the target behaviour.

To conclude, the present findings emphasize that the content of self-formulated, physical-activity-related action plans varied in their specificity and instrumentality. Both plan characteristics, in turn, affected whether participants enacted their plans. To further optimize the efficacy and applicability of planning interventions, intervention designers and researchers alike should use more fine-grained, behavioral indicators of intervention success (i.e., plan enactment) and put more focus on how to best encourage participants to formulate high-quality plans.

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Table 1

Plan Enactment, and Specificity, Instrumentality and Viability Ratings of Action Plans by Plan Component for N=229 participants

	Action plan No. 1 *M (SD)*	Action plan No. 2 *M (SD)*	Action plan No. 3 *M (SD)*	Linear plan rank effect (F-value repeated-measures ANOVA's, partial eta^2)
Action plan component (Range)				
Planned contextual cues				
When specificity (1-3)	2.21 (0.68)	2.10 (0.67)	1.79 (0.66)	32.54, .12*
Where specificity (1-3)	2.42 (0.66)	2.34 (0.70)	2.10 (0.86)	15.46, .06*
Planned behavioral response				
Specificity (1-3)	2.79 (0.45)	2.66 (0.58)	2.26 (0.85)	50.84, .18*
Viability (1-10)	8.64 (2.23)	8.69 (2.32)	8.60 (2.32)	<1, <.01
Overall plan				
Instrumentality (1-10)	8.71 (2.24)	8.72 (2.30)	8.66 (2.43)	<1, <.01
Plan enactment (0-100)[1]	56.33 (40.89)	53.69 (40.76)	54.66 (43.05)	1.13, <.01

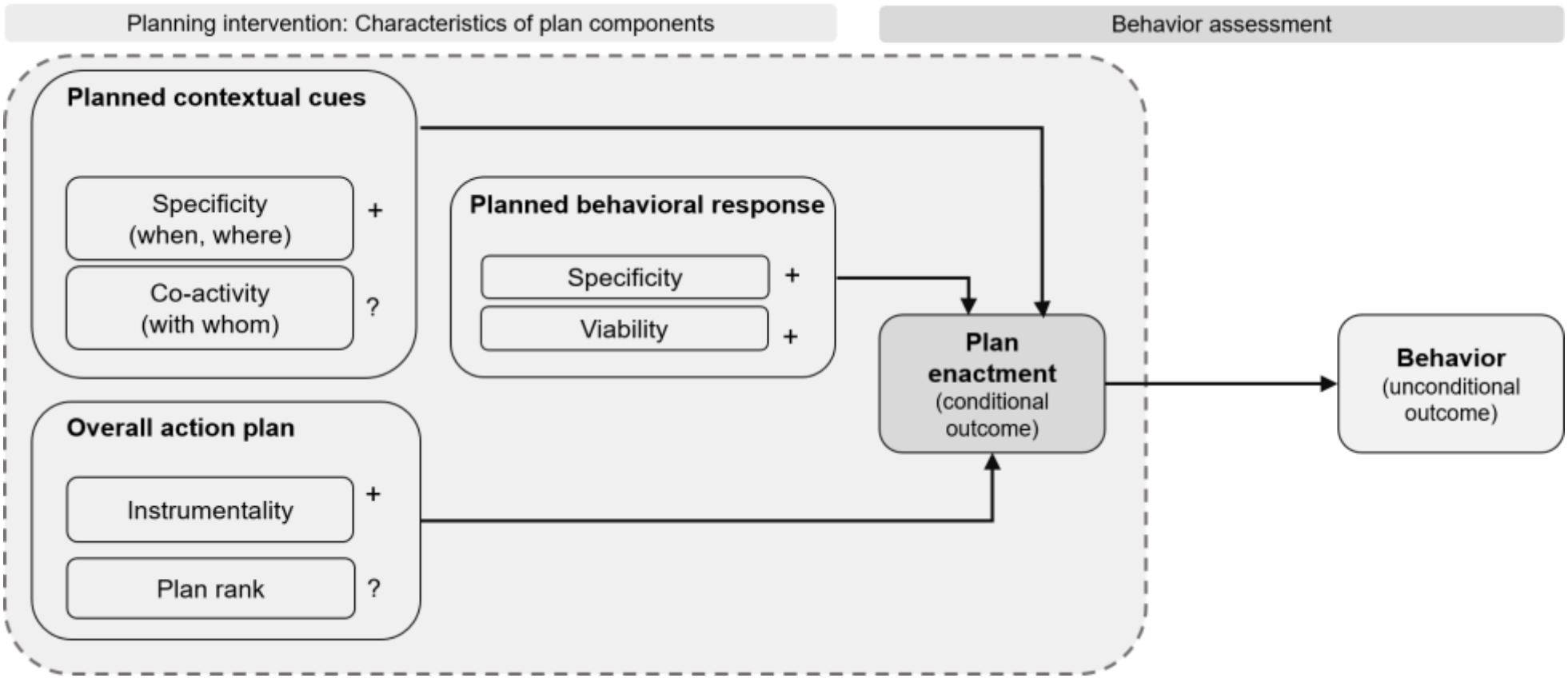
Note. [1]measured 6 weeks after rehabilitation (T2), n=163; *p < .05.

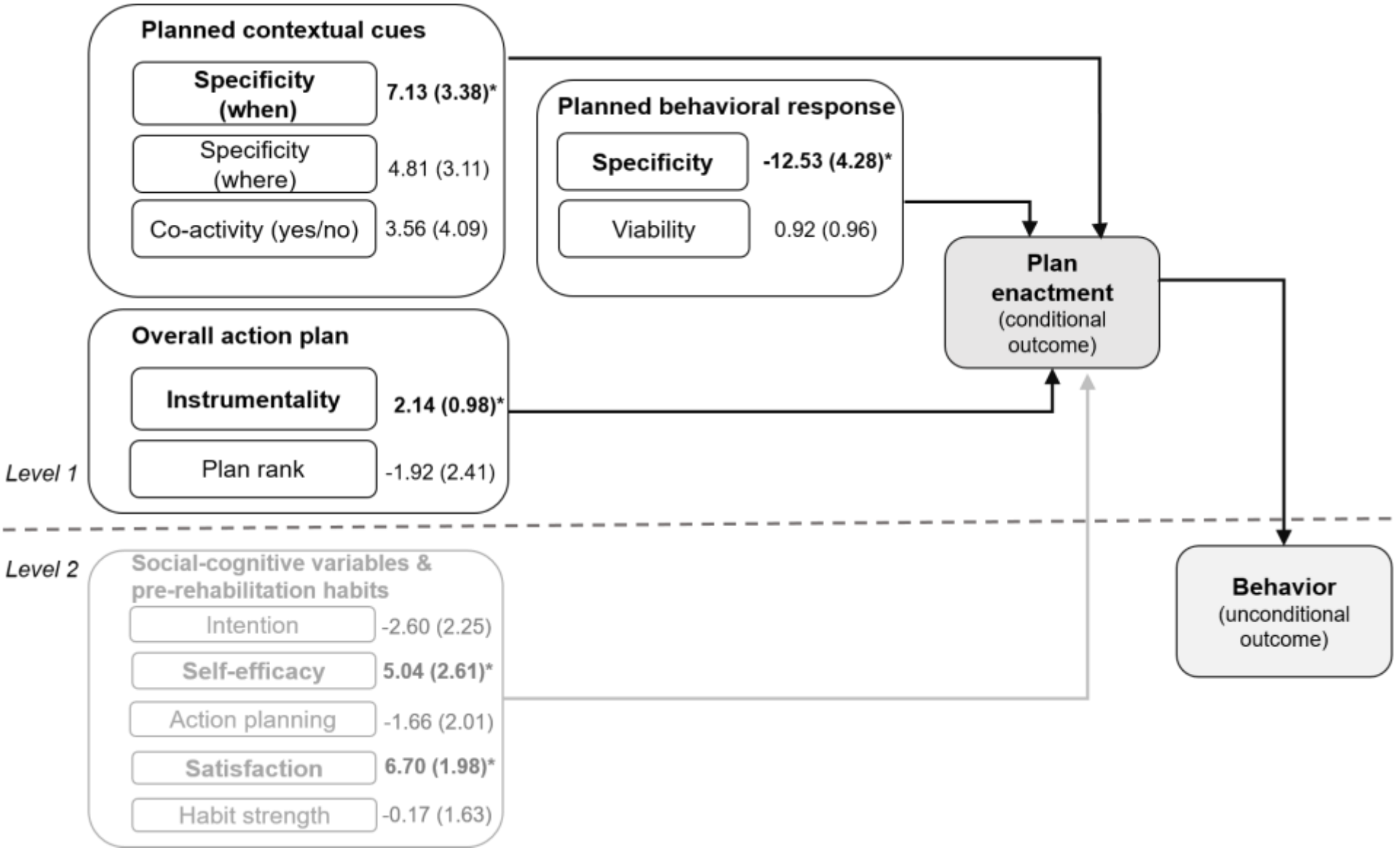
Figure 1. Illustration of hypothesized relationships: What contributes to plan enactment?

Note. --- focus of the present study (grey-shaded area); + hypothesized positive association; ? exploration of association.

Figure 2. Empirical model. Prediction of plan enactment 6 weeks after rehabilitation (n=163)

Note. Unstandardized coefficients, standard errors in parentheses; Controlled for sex, age, BMI, patient group, physical activity habits and overall intervention engagement (p>.05); significant coefficients in bold, *p<.05; intra-class correlation=0.16; the fixed estimate for the intercept of plan enactment equalled 54.63 (SE=3.47), p<.05; in separate analyses, the bivariate correlation between plan enactment and aggregated physical activity equalled r=.59, p<.05.


Planning intervention: Characteristics of plan components
Behavior assessment
Planned contextual cues
Specificity (when, where)
+
Co-activity (with whom)
?
Planned behavioral response
Specificity
+
Viability
+
Overall action plan
Instrumentality
+
Plan rank
?
Plan enactment (conditional outcome)
Behavior (unconditional outcome)


Planned contextual cues
Specificity (when)
7.13 (3.38)*
Specificity (where)
4.81 (3.11)
Co-activity (yes/no)
3.56 (4.09)
Planned behavioral response
Specificity
-12.53 (4.28)*
Viability
0.92 (0.96)
Plan enactment (conditional outcome)
Overall action plan
Instrumentality
2.14 (0.98)*
Plan rank
-1.92 (2.41)
Level 1
Level 2
Social-cognitive variables & pre-rehabilitation habits
Intention
-2.60 (2.25)
Self-efficacy
5.04 (2.61)*
Action planning
-1.66 (2.01)
Satisfaction
6.70 (1.98)*
Habit strength
-0.17 (1.63)
Behavior (unconditional outcome)